UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

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SUBJECT—

TITLE

FOREST INSECT CONTROL IN THE PINE AREAS OF THE SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT ZONE FIVE

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Berkeley, California
April 29, 1940

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UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Entomology and Plant Quarantine
Forest Insect Laboratory - Berkeley, California

April 29, 1940

FOREST INSECT CONTROL IN THE PINE AREAS OF THE SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT ZONE FIVE

(An appraisal of the insect control project conducted during the winter of 1939-40.)

by

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FOREST INSECT CONTROL IN THE PINE AREAS OF THE SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT ZONE FIVE

During the period from January 15 to March 20, 1940, conservation agencies in San Bernardino County conducted a campaign to control the bark-beetle infestations in the watersheds of the Mojave River that drain the Crestline-Arrowhead recreational areas. This was a cooperative program supported by Zone Five of the San Bernardino County Flood Control District and the San Bernardino National Forest. These two agencies acted under the technical advice of the Forest Insect Laboratory of the U. S. Bureau of Entomology and Plant Quarantine at Berkeley, which serves the California region.

This project was undertaken primarily because barkbeetles were killing a great number of pine trees in this district. These infestations were disturbing the normal forest cover of the watershed and were adversely affecting property values dependent upon the maintenance of existing forest types. Also it was believed that the accumulation of dead material resulting from insect depredations was setting up undue fire hazards and otherwise creating a source of potential damage to property in intensively used summer home tracts.

The objectives of the control project were to destroy the insects causing the dying timber, and thereby reduce the possibility of still greater subsequent damage.

It is the purpose of this report to: (1) discuss the basic entomological considerations involved in the protection of this area from pine beetle depredations; (2) appraise the accomplishments of the recent project in meeting requirements necessary to successful control of the insects; and (3) consider the need for further measures necessary for the continuation of a protection program.

INSECTS THAT DESTROY PINES IN THE SAN BERNARDINO AREAS

To be effective, insect control work should be conducted as a fight against specific tree-killing insects with the use of methods adapted to their habits and to the forest conditions of the infested area. For this reason, it seems best to define the problem and list the insect species with which we are concerned.

Not one, but several species of beetles which mine the cambium layer between the bark and wood, go to make up what we call the "pine beetle" infestations.

The Western Pine Beetle (Dendroctonus brevicomis).
Attacks ponderosa and Coulter pines. It selects trees ranging in size from the eight-inch diameter up to the largest specimens, but prefers the older mature trees. When infestations are under control, attacks occur in single scattered trees; when infestations are epidemic, it aggressively attacks trees in groups of as many as fifty. This is the most important species in the area and has caused the bulk of the timber losses.

The Pine Engraver Beetle (Ips confusus).
Attacks ponderosa, Coulter, Jeffrey and sugar pines. It is primarily a top killer of the larger trees, but in small pole sizes, kills entire trees, usually in groups. It breeds prolifically in green slash which thereby becomes a menace to adjacent living trees. Epidemic outbreaks of this engraver are sporadic and they appear suddenly and subside quickly.

The Mountain Pine Beetle (Dendroctonus monticolae).
Attacks sugar pines, and at times ponderosa pines. So far it has not developed epidemics in the San Bernardino areas and is a minor factor in the infestations.

The California Flathead (Melanophila californica).
Attacks all pine species in this area. It is quite different in habits from the other beetles. It works slowly over a period of years in weakened or slow growing trees and kills them by long sustained attacks. It does not develop aggressive epidemics, but is an important factor in the recreational areas because it weakens trees growing on intensively used sites.

CONDITIONS NECESSARY TO SUCCESSFUL CONTROL

So far the only methods that have been proven in pine beetle control are those that reduce beetle populations over a fairly extensive area. As a general rule a tree selected for attack by the beetles is killed quickly. No practical measures are available which can save it after the beetles have become established. If the broods of insects under the bark of infested trees are destroyed, they will not escape to fly to and attack nearby living trees. Peeling and burning the infested bark has been found to be the simplest, least expensive and most effective way of destroying these insects. To carry out a control program with the expectation of securing effective reduction of the insect populations, consideration must be given to the following phases of the operation:

Detection Surveys: These are used to locate the trees that contain the barkbeetle broods, an operation known as "spotting". This work can only be done by well-trained, experienced men who know the evidences of attack, the symptoms of infested trees, and who are able to interpret the potentialities of infestations.

Timing of Control Work: To accomplish its purpose the peeling and burning operation must be done while the broods of tree-killing beetles are in the tree - not prior to the attack or after the emergence. In the fall the beetle populations concentrate in certain trees and remain there until the following spring. It is during this overwintering period of about five months when no new attacks are occurring, that the work can be spread over a fairly large territory and a high percent of the beetle population can be destroyed. Winter control work therefore has decided advantages over that carried on during the summer period while new attacks and emergence of broods are continually occurring.

Coverage of Complete Infestation Units: Because the beetles may fly as far as from one to several miles to attack new trees, treatment of small local centers of infestation is relatively ineffective in breaking up epidemic infestations. Control work should therefore be spread over an extensive area to such type or topographic boundaries as will minimize the flight of beetles from untreated areas. On the basis of a study made in 1939, the Forest Insect Laboratory has designated the infestation units for the San Bernardino areas. These are the best working units that can now be set up for surveys and control operations.

To sum up, we can expect the best results from control when properly timed treatment of those trees infested by the primary tree-killing insects is carried on so as to cover a complete, well-protected infestation unit during the winter period.

SOME RESULTS OF PREVIOUS CONTROL WORK

Past attempts to control pine beetle infestations in the San Bernardino areas throw some light on what results can be expected from the 1940 operation. For this reason it seems best to make a brief survey of previous control work.

In the summer of 1921 a group of large ponderosa pines died suddenly on the north shore of Lake Arrowhead. An investigation showed that these trees had been killed by the western pine beetle, and that there was an active infestation in other parts of the surrounding area. This infestation was considered to be a definite threat to the large investments in summer homes and recreational developments projected for the Lake Arrowhead area. During the winter of 1921-1922 the Arrowhead Lake Company treated 64 infested trees on 5,000 acres and in the course of the work covered their own and adjacent holdings.

This first control work covered only a part of the infestation unit. During the following season of 1922 and 1923, results were shown by a reduction in the number of trees killed in the area covered locally by the control work. However, reinfestation came in from adjoining areas, and during the seasons of 1924 and 1925 the loss of valuable trees again became a serious problem.

Public interest became more general and in 1925, upon petition by a majority of the land owners, the State Board of Forestry set up an eradication district under the pine beetle control law of the State of California.

This district set up the machinery for enforcement of control work throughout an area of about 20,000 acres, practically the same territory as that covered by recent Flood Control project. Costs under the State pine beetle control law, were assessed to the individual ownerships on which the infested trees were found.

The State district functioned for three seasons. Records of the work show the following numbers of trees were treated:

	Trees	Poles	Total
1926	364	237	601
1927	109		109
1928	18	10	28

These results indicate a reduction of about 80 percent in the volume of infestation after the first year, and a decline to a low endemic condition after the second year of control work. The State eradication district was allowed to lapse, apparently because it was considered that the great improvement in conditions did not warrant the attention that was necessary to maintain a community organization to keep up a comprehensive control program.

For a number of years, however, private land owners carried on some work locally in the more intensively used sites, but no effort was directed toward a complete coverage of the infestation units.

The CCC program for the National Forests in Southern California undertook a general eradication program on both Federal and private lands for the winter of 1933-1934. The records of this work show that 66 trees were treated for the Lake Arrowhead district where the infestation was found to be lighter than in other districts which had not previously been worked. This project was planned primarily for the protection of National Forest holdings, and work by the Forest Service CCC organization on private lands was discontinued after the first year (1934).

Further work was carried on at intervals both by private owners and by the Forest Service up to the season of 1939. It can be said, however, that these efforts have been sporadic and localized to a considerable extent in the more intensively used sections of the infestation zones. Infested trees in the fringe type and inaccessible territory in the northern parts of the units were left untreated and continued to breed up beetles to reinfest the treated territory.

So far as we can measure the effects of past work, it is evident that control has been most successful when the eradication work has been planned so as to cover complete infestation units in one season.

CONDITIONS LEADING TO THE 1939-1940 CONTROL PROGRAM

Conditions were highly favorable to the development of barkbeetle epidemics during the season of 1939. Beetles which had escaped the incomplete cleanup of the preceding winter attacked aggressively during the summer and increased rapidly. Group killings of from 20 to 50 trees and poles appeared in some of the most intensively used and highly valuable properties. These conditions caused widespread concern among property owners. Private organizations, individuals and the Forest Service took action to initiate a comprehensive control campaign This resulted in the cooperative project which completed treatment of the overwintering infestation in the Crestline and Lake Arrowhead infestation units. Among the steps which were taken to get this undertaking underway were:

1. A survey of forest insect conditions in the pine types of San Bernardino County by the Forest Insect Laboratory, November 1-15, 1939.

2. A report to the Forest Supervisor and private land owners recommending that control work be carried out throughout the Crestline and Arrowhead units to check epidemic pine beetle infestations. It was urged that this cleanup be completed by April 1, 1940.

3. Approval of the project by the Forest Service and initiation of the spotting in November This advance spotting was undertaken to secure a factual basis for estimates of the volume of trees to be treated, the ownerships involved, and to develop plans for cooperation.

4. Authorization by the Zone Five Flood Control Board to conduct the eradication work on private lands in the district, the costs to become a charge against the funds of the district. The administration of work on private lands was delegated to the County Surveyor of San Bernardino County.

5. Carrying out of the eradication work during the period from January 15 to March 20. Work on the private lands was supervised by Deputy County Surveyor Motherspaw and was in immediate charge of Field Supervisor Leslie Salm. The work on the National Forest lands was under the supervision of District Ranger George Lang.

986
107
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TECHNICAL ACCOMPLISHMENTS OF THE PROJECT

Administrative reports on the work accomplished have been submitted by Leslie Salm for the Flood Control District and by George Lang for the Forest Service. These two reports show how the administration of the work was handled. In Mr. Lang's report, costs are analyzed for the work of treating a total of 986 trees and poles on both Federal and private lands. All but 107 of these trees were in the Crestline-Arrowhead zone of infestation.

During the period April 15 to 20, 1940, John Miller and S. T. Carlson of the Forest Insect Laboratory examined all of the area covered by the control work to determine if the technical requirements for control had been met and if the project had been carried as far as possible toward completion during the current control period. The conclusions drawn from this inspection were that:

1. The selection of infested trees for treatment had been carefully and thoroughly done.

2. Treatment of the infested trees, i.e. burning or other disposal of the infested bark so as to destroy the insect broods, had also been efficiently carried out.

3. Control had been carried to the limits of the infestation units for which the work was recommended.

4. The general requirements for a successful control operation have been met.

EXPECTED NEEDS FOR FURTHER WORK

We can expect that due to the thoroughness of the eradication work during the past winter, epidemic conditions will not reappear during the summer of 1940. Some dying of trees is inevitable, however, due to the pressure of conditions in areas where trees which grew originally in a natural forest are subjected to a city-like environment. A certain number of new trees may become infested during the course of the 1940 season by beetles which may come from any of the following sources.

1. Winter brood trees overlooked by the spotting work during the control period. These would be "late fading" trees which did not show signs of infestation while the control work was in progress. Only one such tree was found during the recent inspection and it is doubtful if enough infestation was missed in spotting to be much of a factor in the 1940 situation.

2. Flight of beetles in from distant untreated infestation units. Since a considerable part of the boundaries of the Arrowhead and Crestline units extend to the limits of the pine type, no great amount of new infestation can be expected from this source.

3. Broods concealed in hidden windfalls or slash material during the winter period. So far as known there is little if any such material.

4. Beetle populations that may develope during the early summer in the logs of green trees cut in clearing for construction work, rights of way, etc. This is perhaps the greatest potential source for new infestations becoming established in the control area. Since there will be a considerable amount of unavoidable clearing connected with the improvement of summer home tracts.

The amount of maintenance control work needed for the coming year will depend upon developments which cannot be accurately estimated at this time. Although the volume of new infestation which may develop through the course of the summer is an unknown quantity, it is suggested that the following control phases be considered for the year beginning May 1, 1940:

1. Summer Control Work: i.e., the treatment of trees which become infested early in the season and which will be abandoned by the insects before fall. A complete cleanup of the area cannot be accomplished by such work because the beetles will be active and continue to fly and attack trees until fall. For this reason, summer control work is not suited to a general district eradication program. Some good can be accomplished by individual owners where accessible summer brood trees can be promptly treated. It is felt that this effort should be encouraged and educational work among the owners to develop a consciousness of the need for and the proper timing of summer control work seems desirable.

2. Winter Control Work: Recleaning of the area under a cooperative program such as the one just completed will be the most effective phase of maintenance control. Because of the long dormant period of the insects, the project can be carefully estimated and planned in advance. This is the type of control work best suited to administration by a district organization. One important phase of such a program is a preliminary survey of the areas about November 1 as a basis for estimates of the amount of work needed. This survey function will again be carried out by the Forest Insect Laboratory if facilities, funds, and personnel are available next fall.

3. Prevention Measures: Much good can be done by lot and tract owners if precautions are taken when improvement projects are underway. These pertain mainly to the proper disposal of slash conditions that are created. Suggestions as to measures which should be observed are attached to this report.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE
FOREST INSECT LABORATORY - BERKELEY, CALIFORNIA

FOREST INSECT SURVEY

ARROWHEAD INFESTATION AREA

SAN BERNARDINO COUNTY, CALIFORNIA
SAN BERNARDINO MERIDIAN

SCALE
In 0 ½ 1 2 3 Miles

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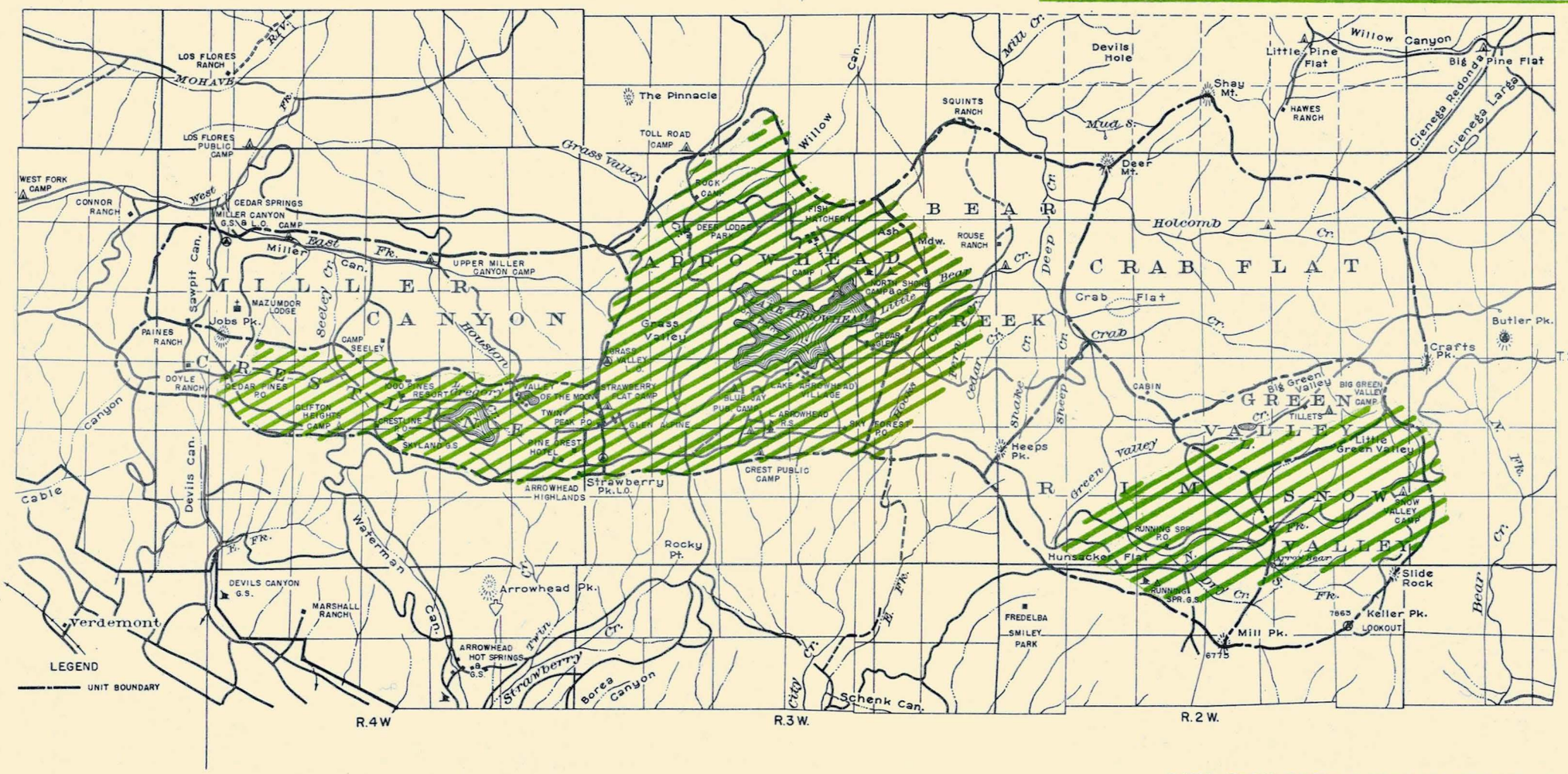
SUMMARY OF FOREST INSECT CONTROL WORK
SAN BERNARDINO FLOOD CONTROL DISTRICT, ZONE 5
JANUARY 15 TO MARCH 20, 1940

INFESTATION UNIT	TREATED		ACREAGE COVERED
	TREES	POLES	
CRESTLINE	174	167	7,700
ARROWHEAD	259	249	13,500
BEAR CREEK	14	16	1,300
RIM, GREEN & SNOW VALLEY	97	10	11,900
	544	442	34,400

AREA COVERED BY CONTROL WORK



DATA FROM REPORT BY DISTRICT RANGER
GEORGE LANG, MARCH 22, 1940.

8/14/39 R.R.

PREVENTION OF BARKBEETLE OUTBREAKS

In the intensively used summer home and recreational areas of the San Bernardino mountains, the control of barkbeetle damage can be considered both as a community program and a responsibility of individual land owners. To keep these areas protected against serious loss of pine trees due to insects, both direct and indirect control measures can be applied.

Direct control measures consist of locating the infested trees and destroying the barkbeetle broods, usually by peeling and burning the infested bark; the best results are secured under a well organized community campaign planned so as to cover the entire infested territory during the winter period while the beetles are inactive.

Indirect or prevention measures apply mainly to the summer period while the insects are active. These methods are concerned with conditions that arise through the intensive use of recreational areas, mainly from the cutting of green trees during construction and improvements on lots and tracts. Precautionary measures to prevent the hazard of insect outbreaks resulting from these operations can best be applied by the individual owners.

Barkbeetles will attack and multiply their numbers in green logs and limbs of trees that have been recently cut. The clearing for rights of way and building sites may thus provide the material in which tree-killing beetles breed up their numbers and then emerge to attack standing green trees either on the site or elsewhere in the area.

The problem of preventing conditions highly favorable to the increase of barkbeetle infestations is a complicated one involving consideration on the part of the owner as to the character and timing of precautionary measures. The following are suggestions which if followed can do much to minimize the threat of new outbreaks.

TIMING OF CUTTING OPERATIONS AND DISPOSAL OF SLASH

1. All work which may entail the injury or removal of green trees, or result in the accumulation of green logs and slash in and around recreational forest areas, should be done during the season of relative inactivity of barkbeetle species (November through March). When cutting during the summer season is necessary, peeling of the logs within a few days after cutting will prevent attack and development of broods.

2. Green logs and slash produced during the winter season should either be removed from the area or burned, peeled, cut up into small pieces of firewood and thoroughly dried before summer. Summer slash should be disposed of as promptly as possible. These measures are necessary to prevent attack or development of barkbeetle broods.

3. Outside of the intensively used summer home areas, such as logging or wood cutting operations, some infestation will result in the slash that is produced. However, if a continuous supply of green logs and slash is available for attack the threat is lessened, as the beetles will keep on infesting the green material. It is from cutting operations that are discontinued in mid season that the more serious damage results.

As a general rule unshaded slash and lopped tops absorb more beetles than are produced in them due to rapid drying out of the inner bark before the broods complete development. Such slash merely serves to concentrate barkbeetle populations in the cutting area and damage does not usually occur in green trees unless no new slash is supplied to absorb the populations.

CONDITIONS THAT SHOULD BE WATCHED CLOSELY

GREEN TREES FELLED AND LEFT UNTREATED: These attract beetles which not only may infest the felled trees but also may kill adjacent standing trees.

ROAD CUTS: If cuts expose or injure root systems, the injured trees are weakened and barkbeetle attacks are invited.

FILLS: The filling in of earth around green trees prevents necessary aeration of roots, weakens the trees and invites insect attacks.

GREEN FIREWOOD: The tiering of green pine firewood in a pine grove attracts beetles which may attack and kill nearby healthy green trees.

USE OF CLIMBERS: If green trees are used for poles for light and telephone lines, these should be put up during the winter when there is no beetle attack going on. Injury to green trees caused by the use of climbers during the flight season may cause sufficient injury to result in the attraction of barkbeetles and the death of the tree.

HACKING, NAILING AND OTHERWISE INJURING GREEN TREES: Thoughtless actions often seriously injure trees around cabins and lead to infestation and death. Trampling of ground and other adverse conditions resulting from intensive use of stands in recreational areas are serious enough without adding to their effects by unnecessary injury.

PARKING AREAS: Trees in parking areas should be protected from injuries resulting from careless driving.

CONSTRUCTION: Green stumps, logs and slash from freshly cut trees and fresh lumber attract barkbeetles, particularly the turpentine beetle. Those insects attack nearby green trees and weaken or kill them. If the preparation of building sites, and construction of buildings, is not feasible during the winter period, all green trees cut or injured in such operations should be peeled, burned, or otherwise treated to prevent attraction and attack by insects.

GROUP KILLS: The attraction of insects to the vicinity of one infested tree often results in the killing of a group of trees. Actions leading to the death of one tree from injury may actually lead to the death of several previously uninjured trees.

THE CHEAPEST AND BEST WAY FOR YOU TO PROTECT YOURSELF AND YOUR NEIGHBORS FROM UNNECESSARY LOSS OF TREES IS TO DO ALL YOU CAN TO PREVENT BARKBEETLE INFESTATIONS.

Forest Insect Laboratory
Berkeley, California

May 1, 1940